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(54) A METHOD OF CLEANING A FLUID CIRCUIT

(71) We, ALFA-LAVAL AKTIEBOLAG, a Swedish Corporate Body of Postfack S-147 00, Tumba Sweden, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed to be particularly described in and by the following statement:—

This invention relates to a method of cleaning a closed fluid circuit by flushing in turn with a series of cleaning liquids.

The invention is particularly applicable to the food industry, such as for cleaning processing equipment in dairy plants. A method has hitherto been proposed for this purpose, in which cold water is initially flushed through the plant to rinse out any remaining milk, and the plant is then flushed through with a lye, rinsed with water again and then possibly flushed with a diluted acid, and finally rinsed with water. The lye which can usually be used repeatedly is pumped from a central supply to the plant and then back to the central supply.

This method has the disadvantage that it involves a considerable waste of water, and in addition the water supply system is very heavily loaded momentarily during the cleaning operation. For the flushing operation to be efficient, the flushing liquid must be passed at a very high flow rate. Furthermore, when the flushing water is to be heated, the steam generating station of the plant is also momentarily very heavily loaded, and the steam generating stations of the plant must be of a very large capacity to cope with the demand for steam during cleaning operations.

The pre-flushing with water in the described manner also results in the milk remaining in the plant becoming too heavily diluted to be made use of.

The lye used for flushing the plant during cleaning is forced out of the plant by a subsequent water rinsing. To enable separation of the lye from the rinsing water a method which has been commonly used involves sensing the electrical conductivity of the liquid flowing in the circuit. When the conductivity drops below a certain value a valve is switched and the liquid is conveyed to the drain of the plant. With this arrangement, however, the indication is extremely indistinct for a number of reasons, and for safety reasons it is necessary to either switch over the flow to the drain long before all the lye has passed the sensor, or switch over to the drain after a considerable quantity of water has been allowed to enter the lye tank with the lye. In both cases losses occur. Furthermore, because the conveying lines to and from the central detergent supply are long and have to be of large dimensions, large losses occur simply because different liquids are conveyed therein.

In accordance with the present invention there is provided a method of cleaning a closed fluid circuit by flushing in turn with a series of cleaning liquids, comprising the steps of metering amounts of each of the cleaning liquids in turn into a tank, the metered amounts being selected in dependence upon the volume of the fluid circuit, supplying the metered amount of one cleaning liquid from the tank to the fluid circuit and circulating the liquid therein, metering the next cleaning liquid of the series into said tank during the circulation of the said one liquid, and removing the said one liquid from the fluid circuit simultaneously with introduction of the said next liquid to the fluid circuit.

The last cleaning liquid is preferably returned to the tank after circulation in the fluid circuit, the amount of liquid in the tank being adjusted in accordance with the volume of a fluid circuit which is to be cleaned next.

A method embodying the invention is

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described below, by way of example, with reference to the accompanying drawing which diagrammatically illustrates a fluid circuit including a section C of a processing plant, a preparation plant A for cleaning liquids, and a supply B for detergents.

A large storage tank 1 of the processing plant C, such as a milk storage tank of a dairy plant, is provided with flushing devices 2 below its top wall, which are rotatably driven by the reaction force when cleaning liquid is supplied under pressure and at a high flow rate through the line 3.

A preparation tank 4 included in the preparation plant A contains an accurately measured predetermined volume of cold water for the cleaning of the tank 1 and its associated tubing system. The quantity of water in the tank 4 is rapidly pumped by means of the pump 6 via the line 7, the heat exchanger 8 and the line 9, 3 to the flushing devices 2 in the tank 1, whereby the system is pre-flushed. The quantity of flushing water is relatively small compared with the volume of the circuit to be cleared, and thus the remaining milk in the system is only slightly diluted. The flushing water and the remaining milk are drained off at the bottom of the tank and conveyed to a special treatment station for further treatment via line 10, 18, 26. During the pre-flushing of the tank 1 no steam is supplied to the heat exchanger 8 to heat the pre-flushing water. To achieve a more effective rinsing of the tank and tubes with cold water, the quantity of water initially supplied may be circulated by pumping via line 10 which together with the pump 6, the lines 7, 9 and 3 and the tank 1 forms a complete circuit.

During this pre-flushing of the tank 1, a second cleaning liquid consisting of a diluted solution of caustic soda is measured into the tank 4. The caustic soda solution is supplied to the tank 4 in an accurately adjusted amount sufficient to fill the tubing system from a central detergent supply 11 by means of the pump 12, the lines 13, 14, 15 and the flow meter 16. On completion of the pre-flushing the lye solution is discharged from tank 4 for repeated flushing of the tank 1 and tubing system by circulation by means of the pump 6. If necessary, the cleaning liquid can be heated during circulation by means of the heat exchanger 8, in which case steam is supplied thereto through valve 17.

At the end of this flushing cycle the soda solution is returned to the supply tank 11 via lines 10, 18, 13 and 19 by draining the section C of the processing plant and the circulation lines 7, 8, 9 3, 10.

During circulation of the lye solution, the next cleaning liquid in the series is supplied to the tank 4. This liquid may be, for example, water at 70°C, supplied to the tank 4 through the water supply system by opening valve 20, and passing it through heat exchanger 21 to be heated to the required temperature and through the flow meter 16 to ensure that the same volume of water is supplied to tank 4 as that of the lye circulating in the flushing circuit. When the circulation of lye is completed the hot water in the tank 4 is introduced into the circulation line and at the same time the valve 22 is opened. The tubing system to be cleaned is completely filled with circulating cleaning liquid so that the lye is displaced from the tubing system by the hot water flowing into the system. When the tank 4 is empty, thus indicating that all of the previously circulating amount of lye has been displaced from the system by the hot water, valve 22 is closed, and a first rinsing operation is commenced by circulating the hot rinsing water. If it is also desired to pasteurize the plant section C during the rinsing, the temperature of the hot water can be raised during circulation to 95°C, for example, by means of the heat exchanger 8.

Any number of cleaning liquids can be individually supplied in turn to the tank 4 to be circulated in succession through the tubing system, each cleaning liquid being accurately measured into the tank 4 of the preparation plant while the preceding cleaning liquid in the series is circulating. The last cleaning liquid of the series, which is rinsing water, is returned to the tank 4 after the final flushing, its volume being measured by the flow meter 16. The amount of water in the tank is adjusted according to the volume of the next fluid circuit to be cleaned, by adding or draining off water as required. The pre-flushing rinsing water for the next cleaning operation is thereby prepared and is held ready in the tank 4. If the section C of the plant cannot be emptied by self-draining, the rinsing water may be forced back to the tank 4 by means of compressed air which is introduced through a valve 25.

It has long been realized that the amount of water consumed by known cleaning methods is excessive, and a previous attempt has been made to save water by conveying the last rinsing water in the series to a collection tank for used rinsing water and taking water from this tank for the pre-flushing in a subsequent cleaning operation. However, this method has the drawback that a flora of bacteria gradually forms in the collection tank and is resistant to both heat and disinfectants. With the described method an effective barrier is provided against the formation of such resistant strains since all flushing water is

removed from the plant and conveyed to the drain thereof after it has been used once or, at a maximum, twice.

In addition in the described method of cleaning a comparatively small quantity of water is consumed, and the pre-flushing is such that the remaining milk need not be diluted to such an extent that it becomes unusable. Heavy momentary loading of the water supply system or the steam generating station is avoided and an efficient recovery of detergent is possible.

WHAT WE CLAIM IS:—

1. A method of cleaning a closed fluid circuit by flushing in turn with a series of cleaning liquids comprising the steps of metering amounts of each of the cleaning liquids in turn into a tank, the metered amounts being selected in dependence upon the volume of the fluid circuit, supplying the metered amount of one cleaning liquid from the tank to the fluid circuit and circulating the liquid therein, metering the next cleaning liquid of the series into said tank during the circulation of the said one liquid, and removing the said one liquid from the fluid circuit simultaneously with introduction of the said next liquid to the fluid circuit.

2. A method according to claim 1, comprising returning the last cleaning liquid of the series to the tank after the circulation thereof in the fluid circuit, and adjusting the amount of liquid in the tank in accordance with the volume of a fluid circuit which is to be cleaned next.

3. A method according to claim 1 or 2, comprising removing the said one cleaning liquid from the fluid circuit by displacing it with an equal amount of the said next cleaning liquid.

4. A method of cleaning a closed fluid circuit substantially as herein described with reference to the accompanying drawing.

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1 SHEET

COMPLETE SPECIFICATION

This drawing is a reproduction of the Original on a reduced scale.